

CLAIMS

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AI 1. An image processing computer system for a
photogrammetric analytical measurement, in which camera

5 parameters necessary for production of a survey map are
determined based on a picture having an image of a target, said
camera parameters representing a photographing position and
a photographing direction of a camera, by which said picture
is photographed, the target having at least three main reference
10 point areas and at least one assistant reference point area,
each of the reference point areas being formed as a high
luminance point area surrounded by a low luminance area, said
computer system comprising:

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a target-image extractor that extracts the image of said
15 target from said picture based on positional relationships
between the main and assistant reference point areas of said
target;

an image processor that processes the extracted image
of said target to determine a two-dimensional position of each
20 of said main and assistant reference point areas of said target
with respect to a two-dimensional picture coordinate system
defined on said image;

a first calculator that calculates three-dimensional
positions of said main reference point areas with respect to
25 a three-dimensional camera coordinate system defined on said

camera;

5 a second calculator that calculates two-dimensional positions of said main reference point areas with respect to a two-dimensional image-plane coordinate system, defined on an image-plane of said camera, based on the three-dimensional positions of said main reference point areas calculated by said first calculator; and

10 a third calculator that calculates camera parameters based on the two-dimensional positions of said main reference point areas with respect to said two-dimensional picture coordinate system and the two-dimensional positions of said main reference point areas with respect to said two-dimensional image-plane coordinate system.

15 2. An image processing computer system as set forth in claim 1, further comprising:

20 a fourth calculator that calculates a three-dimensional position of said assistant reference point area with respect to said three-dimensional camera coordinate system based on the camera parameters calculated by said third calculator;

25 a fifth calculator that calculates a two-dimensional position of said assistant reference point area with respect to said two-dimensional image-plane coordinate system based on the three-dimensional position of said assistant reference point area calculated by said fourth calculator; and

reference point areas with respect to a three-dimensional camera coordinate system defined on said camera;

calculating two-dimensional positions of said main reference point areas with respect to a two-dimensional image-plane coordinate system, defined on an image-plane of
5 said camera, based on the three-dimensional positions of said main reference point areas; and

calculating camera parameters based on the two-dimensional positions of said main reference point areas with respect to said two-dimensional picture coordinate system and
10 the two-dimensional positions of said main reference point areas with respect to said two-dimensional image-plane coordinate system.

4. An image processing method as set forth in claim
15 3, further comprising:

calculating a three-dimensional position of said assistant reference point area with respect to said three-dimensional camera coordinate system based on the calculated camera parameters;

20 calculating a two-dimensional position of said assistant reference point area with respect to said two-dimensional image-plane coordinate system based on the calculated three-dimensional position of said assistant reference point area; and

25 determining whether the calculation of the camera

parameters is correct or incorrect by comparing the two-dimensional position based on said two-dimensional picture coordinate system with the two-dimensional position of said assistant reference point area based on said two-dimensional
5 image-plane coordinate system.

5. A memory medium storing an image processing program for a photogrammetric analytical measurement, in which camera parameters necessary for production of a survey map are determined based on a picture having an image of a target, said
10 camera parameters representing a photographing position and a photographing direction of a camera, by which said picture is photographed, the target having at least three main reference point areas and at least one assistant reference point area, each of the reference point areas being formed as a high
15 luminance point area surrounded by a low luminance area, said program comprising steps of:

extracting the image of said target from said picture based on positional relationships between the main and assistant reference point areas of said target;

20 processing the extracted image of said target to determine a two-dimensional position of each of said main and assistant reference point areas of said target with respect to a two-dimensional picture coordinate system defined on said target;

25 calculating three-dimensional positions of said main

reference point areas with respect to a three-dimensional camera coordinate system defined on said camera;

calculating two-dimensional positions of said main
reference point areas with respect to a two-dimensional
5 image-plane coordinate system, defined on an image-plane of
said camera, based on the three-dimensional positions of said
main reference point areas; and

calculating camera parameters based on the two-dimensional positions of said main reference point areas with respect to said two-dimensional picture coordinate system and the two-dimensional positions of said main reference point areas with respect to said two-dimensional image-plane coordinate system.

6. A memory medium as set forth in claim 5, wherein
15 said program further comprises:

calculating a three-dimensional position of said assistant reference point area with respect to said three-dimensional camera coordinate system based on the calculated camera parameters;

20 calculating a two-dimensional position of said
assistant reference point area with respect to said two-
dimensional image-plane coordinate system based on the
calculated three-dimensional position of said assistant
reference point area; and

25 determining whether the calculation of the camera

parameters is correct or incorrect by comparing the two-dimensional position based on said two-dimensional picture coordinate system with the two-dimensional position of said assistant reference point area based on said two-dimensional
5 image-plane coordinate system.

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